

Remarks/Arguments:

By this Amendment, Applicant has amended claims 1 and 10, and cancelled claims 2 and 3. Accordingly, claims 1 and 4-14 are pending.

Claim Rejections Under § 102 and § 103

Claims 1, 2 and 9 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Cotteverte; and claims 3-8 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Cotteverte and further in view of Beltrami. By this Amendment, Applicant respectfully traverses the Section 102(e) and Section 103(a) rejections.

Claim 1 is an independent claim with claims 4-9 dependent thereon.

Claim 1 is directed to a slab waveguide and includes the following features:

- a two-dimensional crystal grating having columnar members having a refractive index different from the refractive index of a slab and two-dimensionally and periodically arranged along a surface of the slab,
- wherein the refractive index of a slab refractive index portion other than the columnar members in the slab, the number, the shape and the refractive index of said columnar members in the slab are selected so that when a beam of light entering the slab waveguide and traveling periodically, the columnar members and the slab refractive index portion other than the columnar members expands to a maximum extent, and the size of the beam in the slab thickness direction does not exceed the slab thickness,
- wherein the refractive index of the slab refractive index portion in the direction perpendicular to the slab surface is maximized at a predetermined portion other than end portions in the slab refractive index portion, and is not increased with the increase in distance from the predetermined portion, and

- wherein the refractive index of the slab refractive index portion in the direction perpendicular to the slab surface is distributed symmetrically about the predetermined portion.

It is Applicant's position that the slab waveguide defined by claim 1 is patentably distinguished from the Cotteverte Patent and the Beltrami Article at least based on the feature that the refractive index of a slab refractive index portion other than the columnar members in the slab, the number, the shape and the refractive index of the columnar members in the slab are selected so that when a beam of light entering the slab waveguide and traveling periodically, the columnar members and the slab refractive index portion other the columnar members expands to a maximum extent, and the size of the beam in the slab thickness direction does not exceed the slab thickness. Simply put, the foregoing feature is not taught or suggested in the Cotteverte Patent_and the Beltrami Article either separately or in combination.

The Cotteverte Patent shows a part of a core layer 102 where a beam of light travels in a defect waveguide 110 in a photonic crystal device. Because there is no columnar member in the defect waveguide 110, the beam of light is confined along the full length of the photonic crystal device in a horizontal direction by a characteristic of the photonic crystal device; namely, a band gap. The beam of light is confined along the full length of the photonic crystal device in a vertical direction by the difference in a refractive index between the core layer 102, and an overclad layer 104 and an underclad layer 106.

But with respect to the slab waveguide defined by Applicant's claim 1, there are columnar members periodically in a part where a beam of light travels. The beam of light is controlled in the full length of the slab waveguide in a horizontal direction by a characteristic of a photonic crystal, i.e. a dispersion. The beam of light is thus confined along the full length of the slab waveguide in a vertical direction by a balance between the diffusion of the beam of light to the columnar members and the confinement of the beam of light by the distribution of a refractive index in the vertical direction of a slab refractive index portion other than the columnar member in the slab.

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It is Applicant's position that the slab waveguide of claim 1 is in sharp contrast with the teachings of the Cotteverte Patent and is completely different in a configuration of a part where a beam of light travels from Cotteverte.

Applicant notes that the Beltrami Article discloses that a beam of light is confined by the distribution of a refractive index in a vertical direction. But the Beltrami Article does not rectify the deficiencies heretofore described with respect to the Cotteverte Patent.

If the Cotteverte Patent and the Beltrami Article are combined as the Examiner has done in the Section 103(a) rejection, that is a configuration of a beam of light that is confined in the full length of the photonic crystal device in a horizontal direction by a characteristic of the photonic crystal (namely, a band gap), and that the beam of light is confined in the full length of the photonic crystal device in a vertical direction by the distribution of a refractive index in a vertical direction. The reason for the foregoing is that a part of the core layer 102 where a beam of light travels is a defect waveguide 110 in the photonic crystal device, and there is no columnar member in the defect waveguide 110.

However, with regard to the combination of the Cotteverte Patent and the Beltrami Article, because there is no columnar member in a part of the core layer where a beam of light travels, there is no configuration where the beam of light is confined along the full length of the slab waveguide in the vertical direction by a balance between the diffusion of the beam of light to the columnar members and the confinement of the beam of light by the distribution of a refractive index in the vertical direction of a slab refractive index portion other than the columnar member in the slab. Thus, the resulting device from the teaching of the Cotteverte Patent and the Beltrami Article is completely different from the slab waveguide defined by Applicant's claim 1, to which claims 4-9 depend.

The Office Action states at numbered paragraph 12 the following:

It would have been obvious to one having ordinary skill in the art at the time the invention was made to provide a quadratic or approximately quadratic refractive index profile of Beltrami et al. in the device of Cotteverte et al.

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for the purpose of providing periodic focusing characteristics for improving coupling efficiency of the waveguide of Cotteverte et al.

But Applicant respectfully disagrees with the foregoing statement in the Office Action.

The reason for Applicant's disagreement is that because there is no columnar member in a part where a beam of light travels in regard to the Cotteverte Patent, it is not necessary to provide periodic focusing characteristics for improving coupling efficiency of the waveguide of Cotteverte. It is sufficient to provide focusing in an input portion and an output portion.

For the purpose of *arguendo*, if we assume that there are columnar members in a part where a beam of light travels in the Cotteverte waveguide device, the combination of the Cotteverte Patent and the Beltrami Article results in a configuration where columnar members also have the index distribution in a vertical direction, since Cotteverte has a two-dimensional structure where the columnar members and a slab refractive index portion other than the columnar members have a constant refractive index distribution in a vertical direction. This is in sharp contrast with the waveguide slab of Applicant's claim 1 where columnar members have a constant refractive index profile in a vertical direction. Applying the refractive index profile of the Beltrami Article to the waveguide device of Cotteverte and giving only columnar members a constant index profile in a vertical direction contradicts the two-dimensional structure of the Cotteverte Patent.

In view of the foregoing remarks and amendments, it is Applicant's position that the waveguide slab of claim 1 is patentably distinguished from the teaching of the Cotteverte Patent and the Beltrami Article either separately or in combination. Therefore, the Section 102(e) and the Section 103(a) rejections should be withdrawn.

Allowable Subject Matter

Applicant acknowledges with appreciation the Examiner's finding that claims 10-14 include allowable subject matter and would be allowed if rewritten into independent form. Applicant has accordingly amended claim 10 so that it is independent by incorporating the features of original claims 1 and 9. Claims 12-14 are

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dependent on claim 10.. Claim 11 is indirectly dependent on amended claim 1, which is in condition for allowance. Thus, claims 10-14 are now in condition for allowance.

In view of the foregoing remarks and amendments, Applicant respectfully submits that claims 1 and 4-14 are in condition for allowance. Reconsideration and allowance of all pending claims are respectfully requested.

Respectfully submitted,

Daniel N. Calder

Daniel N. Calder, Reg. 27,424
Attorney for Applicant

DNC/fp

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P.O. Box 980
Valley Forge, PA 19482-0980
(610) 407-0700

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Fran Petruillo

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